

CLAIMS

1. An electric power tool, comprising:
 - a housing;
 - a motor encased in the housing and having an output shaft producing a torque;
 - a spindle provided at a front end of the housing, the spindle receiving the torque and capable of rotation;
 - an epicycle reduction gear unit provided between the output shaft of the motor and the spindle, the epicycle reduction gear unit including
 - front and rear internal gears axially arranged and independently rotatable with respect to each other,
 - front and rear carriers, and
 - gear sets each including a front planetary gear having a first diameter and a rear planetary gear having a second diameter different from the first diameter, the front and rear planetary gears being supported on the front carrier so as to revolve on inner peripheral surfaces of the front and rear internal gears, respectively; and
 - switchover means slidably provided on outer peripheral surfaces of the internal gears and responsive to slide operation of the switchover means performed from outside of the housing for selectively prohibiting rotation of the internal gears relative to the housing, the switchover means being capable of coupling one of the two internal gears to the one of the carriers so as to permit integral rotation of the coupled internal gears with the coupled carriers,
 - further wherein the switchover means enables the spindle to rotate
 - at a first speed by prohibiting rotation of one of the internal gears relative to the housing;
 - at a second speed by prohibiting rotation of the other of the internal gears relative to the housing; and
 - at a third speed by simultaneously prohibiting rotation of one of the internal gears relative to the housing and coupling that rotation-prohibited internal gear to one of the carriers.
2. An electric power tool in accordance with claim 1 further comprising a slide member provided in the housing and capable of being slidably operated in axial directions,
 - wherein the switchover means includes an axially movable switchover sleeve mounted on the outer peripheral surfaces of the internal gears and connected to the

slide member so as to allow the switchover sleeve and the slide member to move integrally in the axial directions, and

further wherein slide operation of the slide member causes the switchover sleeve to move to

a first slide position in which the switchover sleeve engages the front internal gear while engaging the housing,

a second slide position in which the switchover sleeve engages the rear internal gear while engaging the housing, and

a third slide position in which the switchover sleeve simultaneously engages the rear internal gears and the rear carrier while disengaged from the housing.

3. An electric power tool in accordance with claim 2, wherein the switchover sleeve is disposed radially inside of the slide member and includes an annular groove provided in an outer peripheral surface thereof, and

further wherein the slide member includes a plurality of pins which penetrate the slide member and are inserted in the annular groove of the switchover sleeve in a manner that allows rotation of the switchover sleeve relative to the slide member while permitting axial slide movement of the sleeve integrally with the slide member.

4. An electric power tool in accordance with claim 1 further comprises:

a first internal gear disposed adjacent to and rear of the rear carrier;

a plurality of first planetary gears engaging and capable of revolving on an inner peripheral surface of the first internal gear; and

a pinion mounted on the output shaft of the motor and engaging the first planetary gears,

wherein the rear carrier is disposed between the first internal gear and the rear internal gear.

5. An electric power tool in accordance with claim 1 further comprising a third carrier disposed forward of the front carrier, wherein the spindle is coupled to the third carrier.

6. An electric power tool in accordance with claim 5 further comprising a clutch assembly provided around the spindle forward of the third carrier for disengaging and interrupting the transmission of the torque to the spindle when a load exerted on the spindle exceeds a user-set value.

7. An electric power tool in accordance with claim 1 further comprising a clutch assembly provided around the spindle forward of the front carrier for disengaging and interrupting the transmission of the torque to the spindle when a load exerted on the spindle exceeds a user-set value.

8. An electric power tool in accordance with claim 1 further comprising a slide member provided in the housing and capable of being slidably operated in axial directions,

wherein the switchover means includes a switchover ring axially aligned with the two internal gears, one of the internal gears is interposed between the switchover ring and the other internal gear, and the switchover ring is rotatable and axially slidable between

a first engagement position in which the switchover ring engages only the internal gear proximate to the switchover ring, and

a second engagement position in which the switchover ring simultaneously engages the proximate internal gear and the carrier proximate to the ring, and the switchover ring is biased to the first engagement position under normal operating conditions, and

further wherein the switchover means further includes an engagement element connected to the slide member so as to allow the engagement element and the slide member to move integrally in the axial directions, the engagement element being capable of selectively engaging the front and rear internal gears and the switchover ring,

further wherein slide operation of the slide member causes the engagement element to move to

a first slide position in which the engagement element engages the internal gear distal to the switchover ring and prohibits rotation of the distal internal gear relative to the housing,

a second slide position in which the engagement element engages and prohibits rotation of the proximate internal gear relative to the housing, and

a third slide position coincidental with the second engagement position, in which the engagement element engages the switchover ring.

9. An electric power tool in accordance with claim 8, wherein the switchover ring is located forward of the front and rear internal gears adjacent to the front internal

gear, such that the front internal gear is the proximate internal gear and the rear internal gear is the distal internal gear, and

further wherein when slid from the second slide position to the third slide position, the engagement element abuts and moves the switchover ring into engagement with the front carrier.

10. An electric power tool in accordance with claim 8, wherein the engagement element is configured to axially slide along and engage the first and second internal gears and the switchover ring so as to selectively prohibit rotation of the internal gears and the switchover ring.

11. An electric power tool in accordance with claim 8 further comprising a third carrier disposed forward of the front carrier, wherein the spindle is coupled to the third carrier.

12. An electric power tool in accordance with claim 11 further comprising a clutch assembly provided around the spindle forward of the third carrier for disengaging and interrupting the transmission of the torque to the spindle when a load exerted on the spindle exceeds a user-set value.

13. An electric power tool in accordance with claim 8 further comprising a clutch assembly provided around the spindle forward of the front carrier for disengaging and interrupting the transmission of the torque to the spindle when a load exerted on the spindle exceeds a user-set value.

14. An electric power tool in accordance with claim 8, wherein the first diameter is greater than the second diameter.

15. An electric power tool in accordance with claim 1, wherein the first diameter is greater than the second diameter.

16. An electric power tool in accordance with claim 2, wherein the first diameter is greater than the second diameter.